

Promoting effect of strontium on lanthanum oxide catalysts for the oxidative coupling of methane

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Oxidative coupling of methane (OCM) is a promising one-step reaction for the direct conversion of natural gas to C₂ hydrocarbons according to the following reactions.¹



The presence of oxygen and the high reaction temperature limit C₂ hydrocarbon yields to below 30% for most catalysts.² Among OCM catalysts, strontium promoted lanthanum oxide has been shown to be highly active for OCM.³ In this work, we examine the promoting role of strontium on lanthanum oxide catalysts for oxidative coupling of methane. A series of strontium promoted lanthanum oxide catalysts with varying strontium loadings (1 to 11 wt%) were prepared. The synthesized catalysts were tested in a fixed bed reactor operating under intrinsic kinetic conditions. Promotion of lanthanum oxide with strontium enhances the activity of the catalysts (Figure 1a). Additionally, the selectivity towards C₂ hydrocarbons is improved when the strontium loading is more than 1 wt% (Figure 1b). For all the catalysts C₂ selectivity increases with temperature and stabilizes.

To understand the promoting effect of strontium on lanthanum oxide, the catalysts were fully characterized using XRD, CO₂-DRIFTS, CO₂-TPD and XPS.

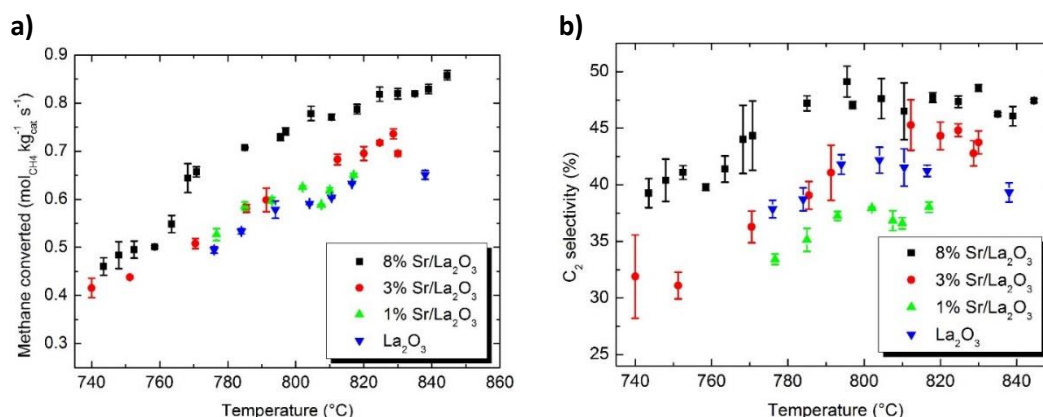


Figure 1: a) Activity and b) C₂ selectivity of unsupported Sr/La₂O₃ catalysts vs. temperature. Other experimental conditions: P_{total} = 1.8 bar (50% He), inlet CH₄:O₂ ratio = 4:1, space time = 0.2-0.25 kg_{cat} s mol⁻¹_{CH₄,0}.

References

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